

**APPROVED MINUTES¹
OPEN SESSION
367TH MEETING
NATIONAL SCIENCE BOARD**

The National Science Foundation
Arlington, Virginia
March 14, 2002

Members Present:

Anita K. Jones, Vice Chair
John A. Armstrong
Nina V. Fedoroff
Pamela A. Ferguson
Mary K. Gaillard
Stanley V. Jaskolski
George M. Langford
Joseph A. Miller, Jr.
Robert C. Richardson
Michael G. Rossmann
Maxine Savitz
Luis Sequeira
Daniel Simberloff
Bob H. Suzuki
Richard Tapia
Warren M. Washington
John A. White, Jr.
Mark S. Wrighton

Rita R. Colwell, NSF Director

Members Absent:

Eamon M. Kelly, Chair
M.R.C. Greenwood
Jane Lubchenco
Diana S. Natalicio
Vera Rubin

¹ The minutes of the 367th meeting were approved by the Board at the May 9, 2002 meeting.

The National Science Board (NSB) convened in Open Session at 1:30 p.m. on Thursday, March 14, 2002, with Dr. Anita Jones, Vice Chair of the Board, presiding (Agenda NSB-02-29). In accordance with the Government in the Sunshine Act, this portion of the meeting was open to the public.

Dr. Jones announced that the Board has three new publications. Two are ready for distribution: *Federal Research Resources: A Process for Setting Priorities*, and *Toward a More Effective Role for the U.S. Government in International Science and Engineering*. The third, *Science and Engineering Indicators 2002*, is embargoed until the White House releases it.

AGENDA ITEM 8: Open Session Minutes, November 2001

The Board APPROVED the Open Session minutes of the November 2001 meeting (NSB-01-208, Board Book Tab D), as corrected.

AGENDA ITEM 9: Closed Session Items for May 2002

The Board APPROVED the Closed Session items for the May 2002 Board Meeting (NSB-02-30, Board Book Tab E).

AGENDA ITEM 10: Vice Chair's Report

a. Board Member Honors

Dr. Jones announced the following honors:

- Dr. Warren Washington has been elected to the National Academy of Engineering for pioneering the development of coupled climate models, their use on parallel supercomputing architectures, and their interpretation.
- Dr. Richard Tapia has been inducted into the Texas Science Hall of Fame, which honors people who shape the world through their innovative use of science.
- Dr. Vera Rubin was profiled in *Science*, with a focus on her pioneering studies of the galaxies and her distinctive career in 20th century astronomy.
- Dr. Jane Lubchenco has received the Heinz Award for the Environment, one of the most significant individual achievement prizes in the world, for her efforts in promoting the protection of the oceans and for her work to advance communication between scientists and the public.

b. NSF's Green Dot Status

Dr. Jones announced that the National Science Foundation (NSF) is the only Federal agency among 26 agencies to receive the green-dot rating on their management scorecard

in the President's budget. The rating is based on smart use of technology, compliance with financial management laws, and low overhead costs.

c. Committee Vice Chairs

Dr. Jones reported that Dr. Eamon Kelly, Board Chair, has named vice chairs of two more committees to assure continuity of Board activities as some members complete their terms in May. Dr. Bob Richardson will serve as vice chair of the *Science and Engineering Indicators* subcommittee, and Dr. George Langford will serve as vice chair of the Task Force on National Workforce Policies for Science and Engineering.

d. Digital Opportunity Investment Trust

Dr. Jones reported that the Board has received requests from the Senate and House to examine the merits of the proposed Digital Opportunity Investment Trust. The proposal is to use proceeds from spectrum auctions to fund educational public service uses of the Internet and other information technologies. The Board Chair will establish a Board committee to examine the issue and respond to the congressional inquiries.

e. Events at May Board Meeting

Dr. Jones reminded the Board that on May 7, the day before the Board meeting, they will have a retreat and the annual awards dinner. During the May meeting, the Board will elect a Chair, Vice Chair, and two members of the Executive Committee for the May 2002 to May 2004 term. In preparation for the May election, the Board has elected a Nominating Committee who will provide a slate of candidates. Nominating Committee members are Drs. Langford, Lubchenco, Maxine Savitz, and Tapia. The committee will elect its own chair.

f. Discharge of Committees

Dr. Jones reported that during the January 24, 2002, Executive Committee meeting, Dr. Kelly discharged three committees.

(1) The Task Force on International Issues in Science and Engineering, chaired by Dr. Diana Natalicio, with members Drs. John Armstrong, Pamela Ferguson, Mary K. Gaillard, Stan Jaskolski, Lubchenco, Luis Sequeira, and Karl Erb, head of the NSF Office of Polar Programs. Dr. Alan Rapoport served as executive secretary.

(2) The Committee on Strategic Science and Engineering Policy Issues, chaired by Dr. Kelly, with members Drs. Armstrong, M.R.C. Greenwood, Jones, Joe Miller, Richardson, and Washington. Ms. Jean Pomeroy served as executive secretary.

(3) The Task Force on the NSB 50th Anniversary, chaired by Dr. Rubin, with members Drs. Lubchenco, Tapia, and Washington. Ms. Susan Fannoney served as executive secretary.

Dr. Washington, reporting for Dr. Rubin, noted that one issue was left unresolved by the task force: whether the Board wants to undertake a more complete history of the National Science Board. The task force suggests that the Audit and Oversight Committee consider that question as part of its review of NSB activities and resources, in the August to October time frame.

AGENDA ITEM 11: Director's Report

a. Staff Introductions

Dr. Rita Colwell, NSF Director, recognized Dr. Esin Gulari, the Acting Assistant Director for Engineering, on her election as a fellow of the American Institute of Chemical Engineers. Dr. Colwell introduced two recently appointed staff: Dr. Peter Freeman, Assistant Director for Computer and Information Science and Engineering (CISE); and Dr. Vasundara Baradan, Director of the Division of Electrical and Communication Systems.

b. Congressional Update

Dr. Colwell reported that the House Science Committee held a hearing on the President's FY 2003 budget on February 13. The committee also held hearings, which included witnesses who have received NSF funding, on the topics of undergraduate education and research. On March 13 the House Science Committee heard testimony from the academic research community in anticipation of an NSF reauthorization bill.

On January 28, Senate bill 1901, the Cyber Security Research and Education Act of 2002, was introduced. It would authorize NSF and the National Security Agency to establish programs to increase the number of qualified faculty who are teaching advanced courses and conducting research in the field of cyber security.

On February 7, the House passed H.R. 3394, legislation that would authorize \$880 million over five years for research and development of technology to combat computer sabotage. Under the bill, NSF would be authorized to create new cyber security research centers, undergraduate program grants, and community college grants and fellowships.

Several hearings are scheduled for March and April. On March 20, the House Science Committee has scheduled a full committee hearing to recognize the winners of the Presidential Awards for Excellence in Math and Science Teaching. Also on March 20, the committee has scheduled a full committee markup of H.R. 2051, which calls for the establishment of regional plant genome and gene expression research and development centers. On March 21, the Senate Commerce, Science and Transportation Committee will hold a hearing on NSF's reauthorization. On April 10, the Senate Veterans Affairs, Housing and Urban Development, (VA, HUD) and Independent Agencies Appropriations Subcommittee will hold a hearing for NSF on the FY 2003 budget request. The House

VA, HUD and Independent Agencies Appropriations Subcommittee will hold a hearing for those agencies on April 11.

On March 13, the House Budget Committee reported out the FY 2003 Budget Resolution, which includes a 5 percent increase for NSF above the FY 2003 request. While the document is not binding, it serves as a guide for allocations to the appropriations committees.

c. Long-Range Planning Environment

Dr. Colwell reported that NSF enjoys exceptionally strong support throughout the Administration and the Congress. In addition, the government and the public have begun to realize that both national security and economic health depend on basic research. NSF's challenge is to articulate goals that are bold and visionary enough to match the confidence that the Nation's leaders have expressed in NSF. Dr. Colwell reminded the Board of three areas in which NSF is prepared to make a historic contribution:

- The quality, size, and diversity of the science and engineering workforce;
- Commitment to meeting the Nation's need for a new class of tools that are powerful enough and versatile enough to enable a new kind of science; and
- Efficiency and productivity of America's academic research enterprise.

Diversity of workforce

Dr. Colwell pointed out the troubling trend of a mismatch between supply and the ever-increasing demand for workers with science and engineering training. A number of congressional leaders have endorsed the creation of a new competitive grant program within NSF that would encourage institutions of higher learning from universities to community colleges to agree to specific enrollment increases in science, math, engineering, and technology.

Dr. Colwell stated that financial support for students is a critical component of ensuring a diverse and globally competitive workforce of scientists and engineers. Also critical is the commitment to attract and retain members of underrepresented groups in science and engineering. At present, the Nation is dependent on foreign-born students and researchers. By 2010, about half of America's school-age population will be from traditional minority groups, and new strategies are needed to take advantage of these demographic shifts.

Infrastructure

NSF invests approximately \$1 billion annually in tools. In fiscal year 2003, the investment will represent approximately 22 percent of the NSF budget. Rapidly expanding frontiers of science and engineering have created enormous pressures for an even greater investment. Current studies by the Board's Task Force on Science and Engineering Infrastructure and by the NSF Advisory Committee on Cyber Infrastructure will highlight changing infrastructure needs. NSF recently submitted two infrastructure reports to Congress: the NSF Large Facilities Management and Oversight Plan, and the

NSF Major Research Equipment and Facilities Construction (MREFC) Account. In addition, a number of disciplinary-specific reports have been completed or are under way.

The studies all highlight a common theme, namely, the need for NSF to support an increasing number of more complex infrastructure projects. New means of doing research are creating unprecedented opportunities, many in fields that have not used these approaches before. The advent of high-speed communication networks and high-performance computing means that the entire science and engineering community may have access to cutting-edge infrastructure. NSF may be called upon to take the Federal leadership in providing for an advanced and integrated cyber infrastructure.

Improved efficiency of the enterprise

Improved efficiency of the research enterprise is a key issue affecting both the near-term and long-term planning for the overall efficiency of the funding process. A year ago, the Office of Management and Budget asked NSF to conduct a thorough analysis of grant size and duration. NSF sent approximately 6,000 web-based surveys to principal investigators (PIs), and the response rate has been more than 90 percent. Many PIs submitted thoughtful and detailed supplemental comments. Survey data will provide a new information base for comparing theoretical work, lab work and field work; and the impact of grant size and duration on the time required to earn degrees, the impact of reductions in budget on project research, and the increases in discovery that could be obtained with appropriate grant size and duration. The results of the survey analysis will be available for the May Board meeting.

Board discussion

In response to questions, Dr. Colwell stated that Dr. Joseph Bordogna, Deputy Director, had been meeting with the Department of Justice's expert for cyber security and that NSF has been working with defense and intelligence agencies as well. Dr. Bordogna added that NSF is part of the group working with Mr. Tom Ridge, Director of Homeland Security. More than a year ago, NSF participated in a workshop with the head of research at the Justice Department and NSF also started a program in CISE on cyber security issues.

AGENDA ITEM 12: Director's Merit Review Report

Dr. Colwell introduced Dr. Nathaniel Pitts, Director of the Office of Integrative Activities, to present the report on merit review.

Dr. Pitts reported that during the past year NSF reviewed close to 32,000 proposals from approximately 2,000 colleges, universities, and institutions and that 96 percent were reviewed using the merit review process. More than 50,000 reviewers were used, and approximately 9,000 of them were new to the system—evidence that the review system is open and transparent. Approximately 10,000 awards were made; the funding rate was 31 percent. The average award per PI was \$113,600 per year.

NSF receives approximately \$16 billion worth of requests and supports around \$2.8 billion, which leaves more than \$13 billion in declined proposals. It is estimated that approximately \$5 billion worth of proposals would be worth the risk of investment if the funds were available.

NSF uses three types of review: mail only review, panel review, and a combination of the two. Data show that the mail only reviews are starting to drop off while the panel reviews are increasing. The return rate for mail review is 60 percent. Panel review can more easily address multidisciplinary activities and compare proposals. The products coming out of panels, however, tend to be more conservative.

NSF is moving toward a totally electronic environment. In 1997, NSF brought in 4 percent of proposals electronically. In 2001, the figure was 99 percent. NSF is moving toward an electronic panel system and video conferencing for proposal and project monitoring. After the anthrax scare in late 2001, in contrast to many Federal agencies, NSF's business practices were not disrupted. NSF's dependency on electronic systems means that security of those systems is a major concern.

Board discussion

During discussion, Board members' comments included the concern that effectiveness, rather than efficiency, be the primary consideration in the selection of the review mechanism (mail or panel); the possibility that program directors' competency could be used to reduce the number of reviews needed per proposal; and the observation that increasing the size and duration of grants could also reduce the number of reviews needed. Dr. Pitts stated that the qualitative comments received as part of survey responses will be a rich source of information on these and other topics.

AGENDA ITEM 13: Environment Activities Report

Dr. Colwell introduced Dr. Margaret Leinen, Assistant Director for the Geosciences, to present an update on NSF's environmental activities.

Dr. Leinen reported that the environmental constituency within and outside of NSF is in the process of developing a Decadal Plan for Environmental Research and Education at NSF, under the leadership of the Advisory Committee on Environmental Research and Education. The plan will provide a view of the contents and scope of the portfolio, identify ways in which the cross-cutting NSF-wide approach adds value, and identify opportunities for future investment at NSF, especially those that fall outside the scope of any individual directorate or research program. The intent is to present a draft plan to the Board in the fall of 2002.

Highlights of the plan are expected to include an emphasis on a research frontier that NSF has made possible through Biocomplexity in the Environment, the activities of individual disciplines, and opportunities for integrated research. The challenge to build capacity to do the research encompasses the intellectual capacity essential to carry out

multidisciplinary research as well as technical challenges and custom-designed technologies to enable scientists to observe and work in new ways.

Board discussion

During discussion, Dr. Leinen noted that broad themes of global change will be imbedded throughout the plan. Partnerships with industry will be encouraged to make the environmental community more aware of existing technology that is going unused, and to let industry know what type of technologies the environmental community would like to have developed. She also noted that discussions are under way to determine how to develop or sponsor model curricular units for grades K-12, which would put science and math concepts into an environmental context.

ADENDA ITEM 14: Committee Reports

a. Executive Committee

Dr. Colwell, committee chair, reported that the Executive Committee met on January 24, 2002, to act on behalf of the full Board on items that needed Board attention before the March meeting. The committee approved two awards: (1) South Pole Station Modernization, an update and request for change of scope with additional funding; and (2) authorization of ALMA FY 2002 design, development and construction funding. In addition, the committee approved a new program, Math and Science Partnership, and a procedure for electing members to the Nominating Committee, which will provide a slate of candidates for the Board election in May.

b. Audit and Oversight (A&O)

Dr. Jaskolski, committee chair, reported that the committee received three presentations: (1) an update from Dr. Deborah Crawford, Staff Associate in the Office of the Director, on the administration and management strategic plan; (2) an update from Ms. Mary Santonastasso, Division Director for Grants and Agreements, on the Grants Oversight and Risk Management Project; and (3) a presentation from Dr. Pitts on the merit review process.

The committee also considered the fiscal year 2001 audit. Contractor staff reported that NSF had received its fourth consecutive unqualified clean audit option; they also reported two conditions regarding internal controls. Mr. Tom Cooley, NSF Chief Financial Officer, commented that NSF is already taking appropriate corrective action. NSF General Counsel Larry Rudolph commented on the auditor's findings as they relate to compliance with the Federal Financial Management Improvement Act.

In the supervisory session, the Office of Inspector General staff made presentations on planned improvements to the semi-annual report to Congress, the status of a review requested by Congress, and a government-wide initiative to establish audit committees at Federal agencies.

In executive session, the committee reviewed the data it has gathered over several months related to the Board's policy studies and statements and expressed concern that the data are insufficiently developed to form the basis for a retreat in May. Dr. Jaskolski will consult with the Board Chair.

c. Committee on Programs and Plans (CPP)

Reporting in the absence of Dr. Armstrong, committee chair, Dr. Washington stated that the committee received from Dr. Richard Hirsh, Acting Division Director of Advanced Computational Infrastructure and Research, a review of the management and oversight of the terascale computing systems and the Distributed Terascale Facility. Dr. Pitts reported on the status of the Science and Technology Centers program. The committee received three informational items: (1) from Dr. Norman Bradburn, Assistant Director of Social, Behavioral and Economic Sciences, on the National Consortium of Violence Research, (2) from Dr. Leinen on the Long-Range Plan for the Academic Fleet Renewal, and (3) from Dr. Christopher Stark, Program Director for Geometric Analysis, Topology and Foundations, on the Mathematical Sciences Research Institutes.

The Polar Issues Subcommittee heard four presentations: (1) the Arctic Regional Research Vessel and the need for replacement of the alpha helix, (2) the meteorite collection regulation issue, (3) recent ecosystem changes in the Bering Sea, and (4) the development of an overland traverse capability for Antarctica as a way to get to the South Pole. The subcommittee also was briefed on a proposed award for the IceCube Neutrino Detector Observatory.

d. CPP Task Force on Science and Engineering Infrastructure (INF)

Dr. John White, task force chair, reported that the task force reviewed a draft set of bullet points on infrastructure implications for NSF's long-range planning process and continued to review the task force's draft report. The task force discussed the directorate reports they have received and found them most informative, particularly in terms of the rapidly changing landscape, congressional interest in MREFC, and the issue of the balance of infrastructure needs. The task force expects to have a draft report ready for CPP's review in August.

e. Education and Human Resources Committee (EHR)

In the absence of the committee chair, Dr. Bob Suzuki, Dr. Tapia reported that Dr. Judith Ramaley, Assistant Director for Education and Human Resources, briefed the committee on recent activities within the EHR Directorate, including the Math and Science Partnership competition. Dr. Ramaley also described two new activities: (1) the Noyce scholarships, which provide supplements to existing support for undergraduate science, engineering, and math students who want to pursue teaching careers; and (2) the Science, Technology, Engineering and Mathematics Talent Expansion Program, or STEP, which is aimed at increasing the number of U.S. citizens pursuing and receiving associate and baccalaureate degrees in science, technology, engineering, and math fields.

The committee received three other presentations: (1) Dr. Norman Fortenberry, Director of the Division of Undergraduate Education, and Dr. Victor Santiago, Program Director for the Historically Black College and University Undergraduate Initiative, provided an update on an ongoing NSF study on NSF diversity-related activities and programs. (2) Ms. Yolanda George, Deputy Director for Education and Human Resources Programs at the American Association for the Advancement of Science, summarized the findings and recommendations of a recently published report “In Pursuit of a Diverse Science, Technology, Engineering and Mathematics Workforce.” (3) Dr. Myles Boylan, Lead Program Director for Program Management in EHR, gave an overview of a survey paper by Dr. Elaine Seymour entitled “Tracking the Process of Change in U.S. Undergraduate Education in Science, Mathematics, Engineering Technology.” Discussion will continue at the next meeting.

In executive session, the committee reviewed and recommended for approval a Request for Proposal for the conduct of the National Survey of Recent College Graduates.

f. EHR Subcommittee on Science and Engineering Indicators (S&EI)

Dr. Tapia, subcommittee chair, reported that Mr. William Noxon, Senior Public Affairs Specialist, updated the subcommittee on plans for the rollout of *Science and Engineering Indicators 2002* on April 9 at the National Press Club.

Dr. Robert Bell, Senior Scientist for Multidisciplinary Reviews, discussed possible changes to the public attitudes chapter in future *Indicators* and presented options for future data collection. Redesign of the NSF survey, which has been the centerpiece of the chapter, cannot be done in time for *Indicators 2004*. Two areas being considered for redesign are the contents (more focus on knowledge in specific areas and less on attitudes and perceptions) and methods (alternative means of collecting data, such as using internet panels to collect public attitudes data).

Dr. Lynda Carlson, Director of the Division of Science Resources Statistics (SRS), discussed possible formats of future editions and outlined options such as timing, content, and structure. SRS recommended and the subcommittee concurred that there not be a separate information technology chapter in the 2004 report, but that information technology be incorporated into the other chapters where appropriate. SRS is also exploring the development of a state science and engineering chapter.

Dr. Bell updated the subcommittee on the status of the feasibility and advisability of an environment chapter in the 2004 edition. A contractor is preparing an options paper based on discussions at a workshop on February 22 that involved staff from NSF, the National Aeronautics and Space Agency, the Environmental Protection Agency, the Department of Energy, and other interested parties.

g. EHR Task Force on National Workforce Policies for Science and Engineering (NWP)

Dr. Miller, task force chair, reminded the Board that in its first year, the task force has examined a broad array of data and recent studies and that now the task force is examining policy options. The overarching issue is the need for the United States to develop its domestic human resources in science and engineering to a higher level, both in numbers and competency.

The workshop held on March 12 focused on policies and actions that will enable the Nation to be more successful in developing human resources at the undergraduate level. One panel was devoted to policies addressing systems-level issues that affect the success of students in moving from pre-college education through a variety of post-secondary educational offerings, and a second panel looked at national policies to strengthen student interest in science, engineering and technology.

The task force plans to conduct another workshop in June or July to examine issues derived from the international character of the advanced science and technology workforce in industry and academia. Topics will include implications of policies concerning immigration, foreign student visas, and high-tech work restrictions.

d. Strategy and Budget (CSB)

Dr. Jones, committee chair, reported that the committee continued to discuss strategic issues affecting the development of NSF's budget. Dr. Bradburn briefed the committee on strategic priority areas in the social and behavioral sciences. The committee discussed the adequacy of financial support for graduate and post-doctoral students. Specific issues were the appropriate balance between fellowships that are awarded directly to students and funding that comes through investigator grants; and the adequacy of the cost of the educational allowances provided under the NSF graduate fellowships. Dr. Colwell briefed the committee on the development of NSF's fiscal year 2003 budget and commented on the fiscal year 2002 budget.

AGENDA ITEM 15: NSF Long Range Planning Environment

(This item was included in the Director's Report, Agenda Item 11, above.)

AGENDA ITEM 16: Other Business

After thanking NSF and Board Office staff who helped prepare for the meeting, Dr. Jones adjourned the Open Session at 3:12 p.m.

Janice E. Baker
Policy Writer/Editor